

ALO--WWID-WIPP-1999-0004

Final Report

Occurrence Report

Waste Isolation Pilot Plant

(Name of Facility)

Nuclear Waste Operations/Disposal

(Facility Function)

Carlsbad Area Office

Westinghouse Waste Isolation Div.

(Laboratory, Site, or Organization)

Name:XXXXXXXXXX**Title:** SURFACE OPERATIONS MANAGEMENT ASST.**Telephone No.:** (505) XXXXXXXX

(Facility Manager/Designee)

Name: XXXXXXXXXXXX**Title:** SURFACE OPERATIONS MANAGEMENT ASST.**Telephone No.:** (505) XXXXXXXX

(Originator/Transmitter)

Name:**Date:**

(Authorized Classifier (AC))

1. Occurrence Report Number: ALO--WWID-WIPP-1999-0004

NEAR MISS TO PERSONNEL INJURY (RESCUE BREATHING APPARATUS)

2. Report Type and Date: Final

	Date	Time
Notification:	07/30/1999	11:45 (MTZ)
Initial Update:	08/23/1999	08:12 (MTZ)
Latest Update:	08/26/1999	10:48 (MTZ)
Final:	08/31/1999	12:35 (MTZ)

3. Occurrence Category: Off-Normal**4. Number of Occurrences:** 1**Original OR:**

5. Division or Project: WIPP**6. Secretarial Office:** EM - Environmental Management**7. System, Bldg., or Equipment:** SELF CONTAINED BREATHING APPARATUS**8. UCNI?:** No**9. Plant Area:** underground**10. Date and Time Discovered:** 07/28/1999 14:00 (MTZ)**11. Date and Time Categorized:** 07/29/1999 09:00 (MTZ)**12. DOE Notification:****13. Other Notifications:****14. Subject or Title of Occurrence:**

NEAR MISS TO PERSONNEL INJURY (RESCUE BREATHING APPARATUS)

15. Nature of Occurrence:

- 10) Cross-Category Items
- B. Near Miss Occurrences

16. Description of Occurrence:

On July 28, 1999, a large scale exercise was conducted by WIPP personnel. The scenario involved an underground fire and explosion with several simulated casualties. Trained mine rescue teams from the WIPP and three commercial potash mines in the area were summoned to the scene. One employee designated to portray a victim was simulated to have severe injuries which required evacuation from the underground.

At approximately 1400, this employee was placed in a Stokes stretcher and secured in position. As the scenario simulated smoke in the underground areas, a Drager model BG4AP Self Contained Breathing Apparatus (SCBA) was placed on the victim. When the stretcher was lifted, the victim experienced difficulty in breathing as the SCBA apparently ceased to provide breathing air. Being strapped into the stretcher, he was unable to remove the face mask of the Drager unit by himself. A safety observer noticed the struggling employee and the mask was removed.

The exercise was terminated immediately and medical personnel summoned to assist the employee, who continued for a few minutes to have difficulty establishing a normal breathing pattern. The employee fully recovered and was escorted from the underground for further medical evaluation. That evaluation

resulted in the employee's return to full duties with no adverse physical effects from his experience.

During the investigation of this event, employee interviews resulted in disclosure of another event which occurred at about the same time and involved a second Drager model BG4AP SCBA. In this event, a different employee was similarly placed in a stretcher and the face mask placed on him. The SCBA appeared to suffer a failure which resulted in intermittent loss of breathing air. A member of the mine rescue team handling this victim periodically activated the manual bypass valve on the SCBA, an action which appeared to alleviate the problem. The victim never suffered distress, and did not report the event to anyone until the investigation team was conducting interviews regarding the first event.

17. Operating Conditions of Facility at Time of Occurrence:

Ambient conditions were normal, training in progress

18. Activity Category:

07 - Training

19. Immediate Actions Taken and Results:

The SCBA mask was removed from the employee, the exercise was terminated, and medical attention summoned. The employee enjoyed a full recovery within minutes. No further exercises requiring the use of SCBAs or extensive simulation techniques will be undertaken until the cause(s) of this event have been determined and appropriate corrective actions taken.

20. Direct Cause:

- 1) Equipment/Material Problem
 - A. Defective or Failed Part

21. Contributing Cause(s):

- 6) Management Problem
 - E. Policy Not Adequately Defined, Disseminated, or Enforced

22. Root Cause:

- 1) Equipment/Material Problem
 - A. Defective or Failed Part

23. Description of Cause:

WIPP mine rescue team equipment was not involved in either of these events. Two of the area commercial potash mines provided mine rescue teams to participate in the exercise. Both events involved

Drager model BG4AP units belonging to one of these potash mine teams. The questionable units were not segregated, and were taken away by the potash mine rescue team when they left the site after the drill was terminated. When the root cause investigation began, the potash mine personnel indicated a willingness to cooperate fully. After stating that their equipment had all been checked out and worked properly, they did not cooperate further. The investigation team was not afforded an opportunity to examine any of the equipment used by the potash mine personnel.

Because they were unable to examine the actual Drager units involved, the root cause analysis team was forced to rely on eyewitness accounts, circumstantial evidence, and expert opinion from WIPP mine rescue team personnel. As a result, the team's findings are the most probable causes, but some degree of uncertainty necessarily attends their conclusions.

The first event has been attributed to a pinched or kinked air breathing hose on the Drager unit. These soft, corrugated rubber hoses have a history of being relatively easy to kink in certain situations. The Drager company has recognized this problem and have recently developed a retrofit kit designed to make the hoses less susceptible to kinks. This kit, Drager part number R34316, has been ordered for all the WIPP BG4AP SCBA units. The WIPP mine rescue teams have been aware of this particular design weakness for some time. Because of the configuration of the hoses on the BG4AP (and the Canadian version BG4CP) it is difficult to avoid a kink when the unit is used on a stretcher patient. The hoses on a Drager model 174A are configured differently, and the WIPP teams use that model on stretchers because the hoses are less likely to be kinked. The WIPP teams have also developed a simple bracket for the model 174A so that it rides on the stretcher in a position which virtually eliminates the possibility of a kinked hose.

The second event wherein a unit appeared to suffer intermittent failure has been attributed to a design problem with the unit which can allow irregular operation. Great care is required during unit maintenance and assembly to ensure the breathing air bag inside the respirator unit is properly attached to the minimum valve, ensuring the bag is not twisted and no wrinkles are present. As the bag gradually deflates during use, it contacts the minimum valve which then opens and adds oxygen to the bag. When the bag is not carefully lined up and attached to the valve body, the minimum valve can actuate intermittently, or not at all. When the bypass valve is manually actuated, oxygen is added to the breathing bag.

Several scenarios can be postulated which might lead to improper unit operation, but an improperly installed breathing air bag is the most likely of those possibilities. In a discussion with a Drager company representative, a member of the investigation team was informed that Drager recognizes this potential and now places a mark on the bag and have added information to their operator's manual which cautions the user to ensure that mark is properly lined up with the minimum valve body and the bag has no twists or wrinkles.

While technical issues with the respirator units appear to be the initiator of these two events, the findings of cause are not limited to SCBA failures. A significant cause was an inadequate appreciation of the potential for placing people at risk during a drill involving actual use of an SCBA. When people are immobilized in a stretcher and a respirator is placed on their face, they are helpless and entirely dependent on the vigilance of others for their safety. This introduces an unnecessary element of risk into the drill scenario. In these events, the victims could have either had their hands left free or the respirator mask placed beside their heads. Either action would have eliminated the necessity for an emergency response if the respirator unit had a failure.

24. Evaluation (by Facility Manager/Designee):

This event occurred at 1400 on July 28. It was not until the formal drill critique on the morning of July 29 that the significance of the event was fully appreciated and it was categorized as a near-miss event.

It appears that the last remaining barrier (a safety observer) was employed to prevent to a significant personnel injury.

The WIPP mine rescue team training coordinator (and a member of this root cause investigation team) is on the MSHA National Mine Rescue Advisory Committee. He attended a meeting of this committee on August 16 through 19, 1999, and used that forum to discuss this event. Committee members expressed a desire to be included in distribution of the findings of our investigation. The Drager company had a representative at the meeting, and provided valuable information concerning their awareness of potential problems and their actions and plans to continue improving their product.

25. Is Further Evaluation Required?: No

26. Corrective Actions

(* = Date added/revised since final report was approved.)

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|--|--|--|-------------------------------------|
| 1. | Install Drager model BG4AP breathing hose upgrade kits on all WIPP units. Drager part number R34316 has been ordered. Install within two weeks of delivery. | | |
| | <table border="1"> <tr> <td>*Target Completion Date: 12/01/1999</td> <td>*Completion Date: 11/16/1999</td> </tr> </table> | *Target Completion Date: 12/01/1999 | *Completion Date: 11/16/1999 |
| *Target Completion Date: 12/01/1999 | *Completion Date: 11/16/1999 | | |
| 2. | Provide investigation results specific to potential Drager model BG4AP malfunctions to the Drager company, local potash mines, and Mine Safety and Health Administration (MSHA) local representatives. | | |
| | <table border="1"> <tr> <td>Target Completion Date: 09/10/1999</td> <td>*Completion Date: 09/15/1999</td> </tr> </table> | Target Completion Date: 09/10/1999 | *Completion Date: 09/15/1999 |
| Target Completion Date: 09/10/1999 | *Completion Date: 09/15/1999 | | |
| 3. | Revise WIPP procedures which provide administrative control of exercises. Revision to include specific prohibition against placing a respiratory device on the face of a simulated victim, and addition of a requirement to perform a formal Job Hazards Analysis during preparation of exercise and drill scenarios. | | |
| | <table border="1"> <tr> <td>Target Completion Date: 09/30/1999</td> <td>*Completion Date: 09/29/1999</td> </tr> </table> | Target Completion Date: 09/30/1999 | *Completion Date: 09/29/1999 |
| Target Completion Date: 09/30/1999 | *Completion Date: 09/29/1999 | | |
| 4. | Continue the ongoing evaluation of the techniques and philosophy employed to simulate or enhance the realism of exercises. Where items are identified which present an element of risk to participants which is not commensurate with the training value received, make appropriate procedure or policy changes to minimize those risks. (Ongoing item with no actual completion date) | | |
| | <table border="1"> <tr> <td>Target Completion Date: 08/26/1999</td> <td>Completion Date: 08/26/1999</td> </tr> </table> | Target Completion Date: 08/26/1999 | Completion Date: 08/26/1999 |
| Target Completion Date: 08/26/1999 | Completion Date: 08/26/1999 | | |

27. Impact on Environment, Safety and Health:

None, but potential for safety and health impacts existed.

28. Programmatic Impact:

None

29. Impact on Codes and Standards:

None

30. Lessons Learned:

Realistic simulations contribute to the training value of an exercise, but introduction of real factors which pose an element of risk must be carefully evaluated. When that evaluation indicates that the risk factor has no commensurate training value, steps must be taken to eliminate or mitigate the risk.

31. Similar Occurrence Report Numbers:

1. None

32. User-defined Field #1:**33. User-defined Field #2:**

34. DOE Facility Representative Input:

35. DOE Program Manager Input:

36. Approvals:

Approved by: XXXXXXXXXXXX, Facility Manager/Designee

Date: 08/26/1999

Telephone No.: (505) XXXXXXXX

Approved by: XXXXXXXXXXXX, Facility Representative/Designee

Date: 08/31/1999

Telephone No.: (505) XXXXXXXX

Approved by: Approval delegated to FR

Date: 08/31/1999

Telephone No.:
